WHAT IS CLAIMED IS:

1. A process comprising:

   a. providing a tool;

   b. introducing an active chemistry onto a workpiece, the active chemistry being capable of reacting with the workpiece to form a conversion coating on the workpiece, the conversion coating being insoluble in the active chemistry such that the conversion coating protects the workpiece from further reaction; and

   c. contacting the tool with the workpiece with a relative motion therebetween, until a desired surface property of the workpiece is reached;

   wherein the contact between the tool and the workpiece removes the conversion coating from the workpiece, thereby exposing the workpiece to further reaction with the active chemistry such that the conversion coating is allowed to reform on the workpiece.

2. The process of claim 1 wherein the surface property of the workpiece is selected from the group consisting of surface finishing, shaping, sizing and combinations thereof.

3. The process of claim 1 wherein the active chemistry is water-based or organic-based.

4. The process of claim 1 wherein the active chemistry comprises active ingredients selected from the group consisting of phosphate salts, phosphoric acid, oxalate salts, oxalic acid, sulfamate salts, sulfamic acid, sulfate salts, sulfuric acid, chromates or chromic acid, and mixtures thereof.

5. The process of claim 1 wherein the active chemistry is a concentrated acid.

6. The process of claim 5 wherein the concentrated acid is sulfuric acid, methane sulfonic acid or phosphoric acid

7. The process of claim 1 wherein the active chemistry comprises activators or accelerators selected from the group consisting of selenium, zinc, copper, manganese, magnesium and iron phosphates.

8. The process of claim 1 wherein the active chemistry comprises inorganic or organic oxidizers selected from the group consisting of persulfates, peroxides,

meta-nitrobenzenes, chlorates, chlorites, nitrates and nitrites and compounds thereof.

9. The process of claim 1 wherein the active chemistry is introduced onto the workpiece with a diluent or a dispersant.

10. The process of claim 9 wherein the diluent or dispersant is selected from the group consisting of water, organic liquids, paraffinic oils, silicone oils, synthetic oils, other oils, lubricants, greases, and combinations thereof.

11. The process of claim 1 wherein the workpiece is formed from a metal.

12. The process of claim 11 wherein the conversion coating comprises a compound selected from the group consisting of an oxide of the metal, a phosphate of the metal, an oxalate of the metal, a sulfate of the metal, a sulfamate of the metal, and a chromate of the metal.

13. The process of claim 11 wherein the metal is selected from the group consisting of iron, titanium, nickel, chromium, cobalt, tungsten, uranium and alloys thereof.

14. The process of claim1 wherein the relative motion between the workpiece and the tool is caused by moving the tool across the workpiece, wherein the workpiece is stationary.

15. The process of claim1 wherein the relative motion between the workpiece and the tool is caused by moving the workpiece across the tool, wherein the tool is stationary.

16. The process of claim1 wherein the relative motion between the workpiece and the tool is caused by simultaneous movement of both the tool and the workpiece, wherein neither the tool nor the workpiece is stationary.

17. The process of claim 1 wherein the tool is non-abrasive.

18. The process of claim 1 wherein the tool is low abrasive.

19. The process of claim 1 wherein the tool is rigid.

20. The process of claim 1 wherein the tool is flexible such that it conforms to the workpiece.

21. The process of claim 1 wherein the tool is a mating surface of the workpiece or a facsimile thereof.

22. The process of claim 21 wherein the tool is formed from a non-reactive material, such that a conversion coating is not formed on the tool.

23. The process of claim 22 wherein the non-reactive material is selected from the group consisting of wood, paper, cloth, ceramic, plastic, polymer, elastomer, and metal.

24. The process of claim 21 wherein the tool is reactive to the active chemistry such that a second conversion coating is formed on the tool.

25. The process of claim 24, further comprising continuing the process until a desired surface property of the tool is reached.

26. The process of claim 25 wherein the surface property of the tool is selected from the group consisting of surface finishing, shaping, sizing and combinations thereof.

27. The process of claim 1 wherein the workpiece comprises the root fillet of a gear, wherein the tool removes surface deformities from the root fillet of the gear, wherein the surface deformities are selected from the group consisting of machine lines, grind lines, shot peening patterns and combinations thereof.

28. The process of claim 1 wherein the workpiece comprises a gear and the tool comprises a mating gear or facsimile thereof.

29. The process of claim 28 wherein the tool is reactive to the active chemistry such that a second conversion coating is formed on the tool.

30. The process of claim 29, further comprising continuing the process until a desired surface property of the tool is reached.

31. The process of claim 30 wherein the surface property of the tool is selected from the group consisting of surface finishing, shaping, sizing and combinations thereof.

32. The process of claim 1 wherein the workpiece comprises a bearing race and the tool comprises a plurality of mating bearing balls or rollers or facsimiles thereof.

33. The process of claim 32 wherein the tool is reactive to the active chemistry such that a second conversion coating is formed on the tool.

34. The process of claim 33, further comprising continuing the process until a desired surface property of the tool is reached.

35. The process of claim 34 wherein the surface property of the tool is selected from the group consisting of surface finishing, shaping, sizing and combinations thereof.

36. The process of claim 1 wherein the workpiece and the tool are assembled in a housing.

37. The process of claim 1 carried out at a temperature less than the thermal degradation temperature of the workpiece.

38. The process of claim 1 wherein the tool is non-abrasive and is contacted with the workpiece at a force less than the plastic deformation of the workpiece.

39. The process of claim 1 wherein the tool is non-abrasive and is contacted with the workpiece at a force less than the shear strength of the workpiece.

40. The process of claim 1 wherein the tool is non-abrasive and is contacted with the workpiece at a force less than the tensile strength of the workpiece.

41. The process of claim 1 wherein the contact between the tool and the workpiece causes material to be removed from the workpiece at a theoretical resolution of 1.0 microinch.

42. A process comprising:

a. providing a first mating gear;

b. introducing an active chemistry onto the first mating gear, the active chemistry being capable of reacting with the first mating gear to form a first conversion coating on the first mating gear, the first conversion coating being insoluble in the active chemistry such that the first conversion coating protects the first mating gear from further reaction;

c. providing a second mating gear, wherein the active chemistry is capable of reacting with the second mating gear to form a second conversion coating on the second mating gear, the second conversion coating being insoluble in the active chemistry such that the second conversion coating protects the second mating gear from further reaction; and

d. contacting the first mating gear with the second mating gear with a relative motion therebetween, until a desired surface property of both the first mating gear and the second mating gear is reached;

wherein the contact between the first mating gear and the second mating gear simultaneously removes the first and second conversion coatings from the first and second mating gears, respectively, thereby exposing the first and second mating gears to further reaction with the active chemistry such that the first and second conversion coatings are allowed to reform on the first and second mating gears, respectively.

43. The process of claim 42 wherein the surface property of both the first mating gear and the second mating gear is selected from the group consisting of surface finishing, shaping, sizing and combinations thereof.

44. The process of claim 42 wherein the first mating gear and the second mating gear are located within a transmission or gearbox, wherein the contact between the first mating gear and the second mating gear occurs during operation of the transmission or gearbox.

45. A process comprising:

a. providing a mating bearing race;

b. introducing an active chemistry onto the mating bearing race, the active chemistry being capable of reacting with the mating bearing race to form a first conversion coating on the mating bearing race, the first conversion coating being insoluble in the active chemistry such that the first conversion coating protects the mating bearing race from further reaction;

c. providing a plurality of mating rolling elements, the active chemistry being capable of reacting with the mating rolling elements to form a second conversion coating of the mating rolling elements, the second conversion coating being insoluble in the active chemistry such that the second conversion coating protects the mating rolling elements from further reaction; and

d. contacting the mating bearing race with the plurality of mating rolling elements with a relative motion therebetween, until a desired surface property of both the mating bearing race and the mating rolling elements is reached;

wherein the contact between the mating bearing race with the plurality of mating rolling elements simultaneously removes the first and second conversion coatings from the mating bearing race and the plurality of mating rolling elements, respectively, thereby exposing the mating bearing race and the plurality of mating rolling elements to further reaction with the active chemistry such that the first and second conversion coatings are allowed to reform on the mating bearing race and the plurality of mating rolling elements, respectively.

46. The process of claim 45 wherein the surface property of both the mating bearing race and the mating plurality of mating rolling elements is selected from the group consisting of surface finishing, shaping, sizing and combinations thereof.